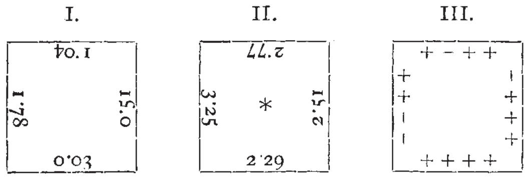
in the middle; III. is unmistakable. It must, however, be understood, that although the values are given to the second place of decimals both in the tables and in this diagram, I do not enter more than one decimal on the dice. The use of the second decimal is to make multiplication more accurate, when a series is wanted in which each term has a larger probable error than 1.



In calculating Table I., *n* was taken as 48. This gives 24 positive and 24 negative values in pairs, but I do not enter the signs on the dice, only the 24 values, leaving the signs to be afterwards determined by a throw of die III. It will be observed that the difference between the adjacent values in Table I. is small at first, and does not exceed 0·2 until the last three entries are reached. These, which are included in brackets, differ so widely as to require exceptional treatment. I therefore calculated Table II. on the principle of dividing that portion of the curve of distribution to which those entries apply, into 24 equal parts and entering the value of the ordinate at the middle of each of those parts in that table. Moreover, instead of entering the three bracketed values on die I. I leave blanks. Then whenever die I. is tossed and a blank is turned up, I know that I have to toss die II., and to enter the value shown by it.

The precise process I follow is to put 2 or 3 of dice I. into a small waste-paper basket, to toss and shake them, to take them out and arrange them on a table side by side in a row, squarely in front of me, but by the sense of touch alone. Then for the first time looking at them, to write down the values that front the eye. If, however, one of the blank spaces fronts me, I leave a blank space in the entries. Having obtained as many values as I want from die I., I fill up the blank spaces by the help of die II.

Lastly, the signs have to be added. Now as $24 = 16 + 8 = 2^4 + 2^3$, it follows that 16 of the edges of die III. may be inscribed with sequences of 4 signs in every possible combination, and the remaining 8 with sequences of 3 signs. Then when die III. is thrown, the several entries along its front edge, which are 4 or 3 in number as the case may be, are inserted in an equal number of successive lines, so as to stand before the values already obtained from the other dice.

The most effective equipment seems to be 3 of die I., 2 of die II., 1 of die III., making 6 dice in all.

Values for Die I.

0·03	...	0·51	...	1·04	...	1·78
0·11	...	0·59	...	1·14	...	1·95
0·19	...	0·67	...	1·25	...	2·15
0·27	...	0·76	...	1·37	...	(2·40)
0·35	...	0·85	...	1·50	...	(2·75)
0·43	...	0·94	...	1·63	...	(3·60)

Values for Die II.

2·29	...	2·51	...	2·77	...	3·25
2·32	...	2·55	...	2·83	...	3·36
2·35	...	2·59	...	2·90	...	3·49
2·39	...	2·64	...	2·98	...	3·65
2·43	...	2·68	...	3·06	...	4·00
2·47	...	2·72	...	3·15	...	4·55

Values for Die III.

+ + + +	+ − − +	− − + +	+ − +
+ + + −	+ − − −	− − + −	+ − −
+ + − +	− + + +	− − − +	− + +
+ + − −	− + + −	− − − −	− + −
+ − + +	− + − +	+ + +	− − +
+ − + −	− + − −	+ + −	− − −

Francis Galton.

THE ROYAL SOCIETY SELECTED CANDIDATES.

The following fifteen candidates were selected on Thursday last (April 24) by the Council of the Royal Society to be recommended for election into the Society. The ballot will take place on June 5, at 4 p.m. We print with the name of each candidate the statement of his qualifications.

Sir Benjamin Baker, Mem. Inst. C.E.,

Hon. Mem. of the American Society of Mechanical Engineers, and of the Society of Engineers. Hon. Mem. of the Manchester Lit. and Phil. Soc. Has been engaged as an Engineer during the last twenty-five years, in the design and construction of many important works at home and abroad, including the Forth Bridge, and has carried out numerous investigations relating to the strength of materials and of engineering structures generally, and has contributed papers thereon to various Scientific Societies, viz., Proc. Inst. Civil Eng., Trans. Amer. Soc. Mech. Eng., Brit. Assoc. Reports, &c. Author of "A Theoretical Investigation into the Most Advantageous System of Constructing Bridges of Great Span," upon which plan the Forth Bridge and six of the largest bridges in the world have been built.

Robert Holford Macdowall Bosanquet, M.A.,

Fellow of St. John's College, Oxford. Barrister. Long and successful devotion to scientific inquiry, as shown by the following list of papers, and the printed copies sent herewith for the use of the Council:—"On an Experimental Determination of the Relation between the Energy and Apparent Intensity of Sounds of Different Pitch" (*Phil. Mag.*, xliv., 381–387); "On Just Intonation in Music; with a Description of a New Instrument for the Easy Control of all Systems of Tuning other than the Ordinary Equal Temperament" (Roy. Soc. Proc., xxi., 131–132); "Note on the Measure of Intensity on the Theories of Light and Sound" (*Phil. Mag.*, xlv., 215–218); "The Theory of the Division of the Octave, and the Practical Treatment of the Musical Systems thus obtained" (Roy. Soc. Proc., xxiii., 390–408); On the Polarization of the Light of the Sky" (*Phil. Mag.*, l., 497–520); "On a New Form of Polariscope and its Application to the Observation of the Sky" (*Phil. Mag.*, ii., 20–28); "On the Hindoo Division of the Octave, with some Additions to the Theory of Systems of the Higher Orders" (Roy. Soc. Proc., xxv., 540–541, xxvi., 372–384); "On the Relation between the Notes of Open and Stopped Pipes" (*Phil. Mag.*, vi., 63–66); "On the Present State of Experimental Acoustics" (*ibid.*, viii., 290–305); "Notes on Practical Electricity" (*ibid.*, xiv., 241–258); "On a Uniform Rotation Machine, and on the Theory of Electromagnetic Tuning Forks" (Roy. Soc. Proc., xxxiv., 445–447); "On Magneto-motive Force" (*Phil. Mag.*, xv., 205–217); "On Permanent Magnetism" (*ibid.*, 257–259, 309–316); "On Self-regulating Dynamo-electric Machines" (*ibid.*, 275–296); "On a Standard Tension Galvanometer" (*ibid.*, xvii., 27–30); "On a Determination of the Horizontal Component of the Earth's Magnetism at Oxford" (*ibid.*, 438–447); "On Electro-Magnets," No. I. (*ibid.*, 531–536); No. II., "On the Magnetic Permeability of Iron and Steel, with a new Theory of Magnetism" (*ibid.*, xix., 73–94); No. III., "Iron and Steel: a New Theory of Magnetism" (*ibid.*, 333–340); No. IV., "Cast Iron, Charcoal Iron, and Malleable Cast Iron" (*ibid.*, xx., 318–323); "Permanent Magnets," No. I. (*ibid.*, xviii., 142–153), No. II., "On Magnetic Decay" (*ibid.*, xix., 57–59); "On the Supposed Repulsion between Magnetic Lines of Force" (*ibid.*, 494–495). With a further list of twenty-seven papers.

Samuel Hawkesley Burbury, M.A.,

Barrister-at-Law. Formerly Fellow of St. John's College, Cambridge. Second Classic, and Chancellor's Medallist, and fifteenth Wrangler in the year 1854. Has done much work in Mathematical Physics, espeially in the theories of Electricity and Magnetism and the Kinetic Theory of Gases. Joint author of Watson and Burbury's "Generalized Co-ordinates"; also of Watson and Burbury's "Electricity: Part I. Electrostatics." Author of sundry papers on physical science; for example, the following: Paper in *Phil. Mag.*, January 1876, "On the Second

Law of Thermodynamics in Connection with the Kinetic Theory of Gases"; *ibid.*, 1877, "On Action at a Distance in Dielectrics"; *ibid.*, 1881 (joint author), "On the Law of Force between Electric Currents"; *ibid.*, 1882, "A Theorem on the Dissipation of Energy"; *ibid.*, 1886, "Remarks on Prof. Tait's Paper 'On the Kinetic Theory of Gases'"; "Encycl. Brit." (joint author) Article, "Molecule." Attached to Science, and anxious to promote its progress.

Walter Gardiner, M.A. (Cantab.),

F.L.S., Fellow of Clare College, Cambridge. University Lecturer in Botany. Rolleston Prize, 1888. Author of numerous papers containing original observations and discoveries in Vegetable Physiology, of which the following are the more important:—"The Development of the Water-glands in the Leaf of *Saxifraga crustata*" (*Quart. Journ. Micros. Sci.*, 1881); "On the Continuity of Protoplasm through the Walls of Vegetable Cells" (Phil. Trans., 1883, and Sachs, *Arbeit. d. Bot. Inst. in Würzburg*, Bd. iii.); "On the General Occurrence of Tannin in the Vegetable Cell, and a possible View of its Physiological Significance" (Camb. Phil. Soc. Proc., 1883); "On the Changes in the Gland-cells of *Dionæa muscipula* during Secretion" (Roy. Soc. Proc., 1883); "On the Phenomena accompanying Stimulation in the Gland-cells of *Dionæa dichotoma* (*ibid.*, 1886); "On the Power of Contractibility exhibited by the Protoplasm of certain Plant-cells" (*ibid.*, 1887); "On the Structure of the Mucilage Secreting Cells of *Blechnum occidentale* and *Osmunda regalis*" (*Ann. of Bot.*, 1887).

John Kerr, LL.D.,

Mathematical Lecturer in the Free Church Training College, Glasgow. Discoverer of the optical effects of Electrostatic Stress in transparent solids and liquids; and of the optical effects of magnetism on light reflected from iron.

Arthur Sheridan Lea, D.Sc. (Cantab.),

Fellow, Lecturer in Physiology, and Assistant Tutor of Gonville and Caius College, Assistant Lecturer of Trinity College. University Lecturer in Physiology. Author of the following papers:—"Ueber die Absonderung des Pancreas" (Heidelberg, 1876); "Some Notes on the Urea Ferment" (*Journ. of Physiol.*, vol. iv., 1883); "On a Rennet Ferment contained in the Seeds of *Withania coagulans*" (Proc. Roy. Soc., 1883); "On the Comparison of the Concentration of Solutions of Different Strengths of the same Absorbing Substance" (*Journ. of Physiol.*, vol. v., 1884); "Some Notes on the Isolation of a Soluble Urea Ferment from the Torula Ureæ;" "On the Digestion of Carbohydrates" (Physiol. Soc., May, 1886, *Journ. of Physiol.*, vol. vi., 1885). Author of the Appendix to Foster's "Physiology." Is distinguished for his acquaintance with Physiology. Is attached to Science, and anxious to promote its progress.

Percy Alexander MacMahon, Major, R.A.,

As author of numerous papers in the *Quart. Journ. Math.*, vols. xix.-xxi., Proc. Lond. Math. Soc., vols. xv.-xix., *Amer. Journ. Math.*, vols. vi.-xi., on various subjects in Pure Mathematics, connected with Invariants, Semivariants, Perpetuants, Reciprocants, Partitions, Distributions, and Symmetric Functions. Associate Member of the Ordnance Committee. Instructor in Mathematics at the Royal Military Academy, Woolwich, 1882-88.

Alfred Merle Norman, M.A. (Oxon.),

Hon. Canon of Durham, D.C.L. (Durh.), F.L.S. Eminently distinguished for his researches in Marine Invertebrate Biology, carried on continuously for thirty-seven years. In 1880, Dr. Norman, by the special invitation of the French Government, took part in the deep-sea exploration in the Bay of Biscay, on board *Le Travailleur*, and for his services received, in 1884, the commemoration medal of the Institute of France. He edited, with additions, vol. iv. of "Monograph of British Spongiadæ," by the late J. S. Bowerbank, for the Ray Society. Author, along with T. R. Stebbing, of Crustacean Isopoda of the *Lightning*, *Porcupine*, and *Valorous* expeditions in the Zool. Soc. Trans., 1886; along with G. S. Brady, F.R.S., "Monograph of the Marine and Fresh-Water Ostracoda of the North Atlantic and North-West Europe," Roy. Dubl. Soc. Trans., 1889; "Report on the Crustacea of the Faroe Channel—H.M.S. *Knight Errant*" (1880). Author of over forty other reports published in the Brit. Assoc. Reports, *Ann. and Mag. Nat. Hist.*, *Journ. Conchol.*, *Journ Micros. Sci.*, &c., &c. Chairman of the Jury on Natural History at the Fisheries Exhibition, 1883. Possessor of Collections of the Invertebrate Fauna of the North Atlantic and Arctic Oceans, which are probably unequalled, and are always at the disposal of authors, as may be seen in every work published in Britain on the subject for the last twenty years.

William Henry Perkin, Jun., Ph.D.,

F.I.C., F.C.S. Professor of Chemistry in the Heriot Watt College, Edinburgh. Formerly Privatdocent and Assistant in the Chemical Research Laboratory of the University of Munich. Distinguished as an Investigator, especially in devising new synthetic methods for the preparation of organic compounds containing closed carbon chains and in studying the properties of this important class of substances. This work has attracted great attention, both in this country and on the Continent. Author, and joint author, of upwards of fifty papers, published partly in the Journal of the Chemical Society, and partly in the *Berichte* of the German Chemical Society. Amongst others—"Condensation Products of Oenanthol," "Condensation Products of Isobutylaldehyde," "Benzoylacetic Acid and some of its Derivatives," "Synthetical Formation of Closed Carbon Chains," "Action of Trimethylene Bromide on Ethylic Aceto-acetate, Benzoyl-acetate and Malonate," "Action of Ethylene Bromide on Ethylic Aceto-acetate and Benzoyl-acetate," "Action of Ethylene Bromide on Ethylic Malonate," "Trimethylene Derivatives," "Some Derivatives of Tetramethylene," "Pentamethylene Dicarboxylic Acid," "Some Derivatives of Hexamethylene," "Derivatives of Hydrindonaphthene," "New Synthesis of Naphthalene Derivatives," "Dehydracetic Acid," "Phenylenediacrylic Acid," "Paranitro-benzoylacetic Acid," "Ethylic Diacetyladipate," "On Kamala," and "On Berberine." As a teacher he has been especially successful in suggesting and directing research work, as evinced by the number of papers he has published in conjunction with his students.

Spencer Umfreville Pickering, M.A.,

F.C.S. Professor of Chemistry at Bedford College. Distinguished as as investigator of the thermal changes attending dissolution of salts. Author of papers on "The Action of Sulphuric Acid on Copper," "The Action of Hydrochloric Acid on Manganese Dioxide," "Sodium Thiosulphate and Iodine," "Basic Sulphates of Iron," "Sulphides of Copper," "The Constitution of Molecular Compounds," "Modifications of Sodium Sulphate," "Heat of Dissolution of Potassium and Lithium Sulphates," "Calorimetry of Magnesium Sulphates," "Modifications of Double Sulphates," "Multiple Sulphates," "Influence of Temperature on the Heat of Chemical Combination," "Water of Crystallization," "Heat of Hydration of Salts," and others, in all about forty, published in the Journ. Chem. Soc., the *Phil. Mag.*, and the *Chem. News*.

Isaac Roberts, F.R.A.S.,

F.G.S., V.-P. of the Literary and Phil. Soc. of Liverpool. Discovery and publication, by aid of photographic methods, of Nebulæ in Andromeda, Orion, the Pleiades, and Vulpecula. Charting by photography a considerable portion of the stars of the northern hemisphere. Rediscovery of a minor planet by photography. Improvements in the apparatus and methods for giving long exposures in stellar photography. Invention of a machine for accurately charting the stars in a permanent manner by engraving them upon metal plates directly from the photographic negatives. The machine is also adapted for measuring the positions and magnitudes of the stars (*Monthly Notices*, Roy. Astron. Soc.). Determination of the Vertical and Lateral Pressures of Granular Substances (Proc. Roy. Soc., 1884); Investigation of the Movements of Underground Waters in Porous Rocks. Various papers on astronomical and geological subjects (see "Cat. of Sci. Papers, Roy. Soc."). Often finding opportunities of rendering valuable aid to those engaged in scientific research.

David Sharp, M.B., C.M. (Edin.),

President of the Entomological Society of London. Hon. Memb. Inst. New Zealand, &c. Distinguished as an Entomologist, especially for his knowledge of the order Coleoptera, many of the more intricate groups of which he has studied with reference to their structure, classification, geographical distribution, &c.; is attached to Science, and anxious to promote its progress. Author of the following memoirs:—"On Aquatic Carnivorous Coleoptera or Dytiscidæ," forming Vol. II. (Ser. 2) of the Scient. Trans. Roy. Dubl. Soc., 1879-82; "Memoirs on the Coleoptera of New Zealand" (*ibid.*, 1886); and, with the Rev. T. Blackburn, "Memoirs on the Coleoptera of the Hawaiian Islands" (*ibid.*, 1885); besides upwards of one hundred minor contributions to the Transactions of various Societies in England and on the Continent. Has also just completed a memoir on the Dytiscidæ, Staphilinidæ, &c., of Mexico and Central America, being Coleoptera, Vol. I., Part 2, of Messrs. Godman and Salvin's "Biologia Centrali-Americana" (pp. 824, pls. 19), and is now engaged in studying the Clavicornia and Rhynchophora for the same work. Since 1885 he has written the whole of the Insecta (except the Neuroptera) for the *Zoological Record.*

J. J. Harris Teall, M.A.,

F.G.S. Has taken a leading place among the petrographical geologists of this country, having enriched the literature of the science with important original contributions. Among these, special mention may be made of the following:—"The Patton and Wicken Phosphatic Deposit" (Sedgwick Prize Essay, 1875); "Petrological Notes on some North of England Dykes" (*Quart. Journ. Geol. Soc.*, 1884, p. 209); "On the Chemical and Microscopical Characters of the Whin Sill" (*op. cit.*, p. 640); "The Metamorphism of Dolerite into Hornblende-schist" (*op. cit.*, 1885, p. 133); "The Lizard Gabbros" (*Geol. Mag.*, 1886, p. 481); "On the Origin of certain Banded Gneisses" (*op. cit.*, 1887, p. 484). In 1888 he published a valuable treatise on "British Petrography," containing the results of much original research, and presenting for the first time a general review of the microscopic characters of all known British rocks. In the same year he was appointed to the Geological Survey, where he is specially charged with the investigation of the petrography of the crystalline schists.

Richard Thorne Thorne, M.B. (Lond.),

F.R.C.P. Assistant Medical Officer to H.M. Local Government Board. Has made numerous original observations in regard to the spread of disease, and especially on an epidemic of typhoid fever, and its dissemination by water at Caterham and Redhill. Author of "The Use and Influence of Hospitals for Infectious Diseases" (Proc. of the Internat. Sanit. Conference at Rome); and of a large number of Reports on Public Health to the Privy Council and Local Government Board. He was appointed along with Sir W. G. Hunter to represent Great Britain at the International Sanitary Conference of Rome, 1885. Is distinguished for his acquaintance with Sanitary Science, as shown by his being President of the Epidemiological Society, Lecturer on Public Health at St. Bartholomew's Hospital, Examiner in Public Health to the University of Oxford, the University of London, and the English Conjoined Board.

Walter Frank Raphael Weldon, M.A.,

Fellow of St. John's College, Cambridge. University Lecturer on the Advanced Morphology of Invertebrates in the University of Cambridge. Author of: (in the *Quart. Journ. Micros. Sci.*, 1883-88) "Note on the Early Development of *Lacerta muralis*"; "On the Head-kidney of *Bdellostoma*"; "On the Supra-renal Bodies of Vertebrata"; "*Dinophilus gigas*"; "*Haplodiscus piger*"; (in the Proc. Zool. Soc., 1884) "On some Points in the Anatomy of *Phœnicopterus* and its Allies"; "Note on the Placentation of *Tetraceros quadricornis*"; "Notes on *Callithrix gigot*"; (in the Proc. Roy. Soc.) "Note on the Development of the Supra-renal Bodies of Vertebrates"; "Preliminary Note on a Balanoglossus Larva from the Bahamas"; Note on the last paper; and a Report of Investigations into the Crustacean Fauna of Plymouth Sound, carried on in the laboratory of the Marine Biol. Assoc., in accordance with instructions from a Committee appointed by the Royal Society.

NOTES.

M. Eugène Peligot, the eminent French chemist, died at Paris on April 15. He was born on March 24, 1811. In 1832 he was admitted to the laboratory of J. B. Dumas, and three years afterwards he became Professor of Chemistry at the École Centrale. In 1846 he succeeded Clément Desormes at the Conservatoire des Arts et Métiers; and here, until recently, he continued to deliver courses of lectures on general chemistry. He also lectured at the National Agricultural Institute on analytical chemistry applied to agriculture. For more than 40 years he was connected with the French Mint, and at the Hôtel des Monnaies he lived and died. M. Peligot was elected a member of the Paris Academy of Sciences in 1852, and in 1885 he received the dignity of a Grand Officer of the Legion of Honour.

The death of Dr. F. Soltwedel, Director of the Botanical Station at Semarang, in Java, is announced. He was a very energetic botanist, especially in the direction of applied botany.

We learn from the *Botanisches Centralblatt* that Mr. Thomas Hanbury, of Mortola, near Mentone, has offered to defray the expense of the erection of a building in the Botanic Garden at Genoa, to provide a laboratory, lecture-rooms, and space for botanical collections. The building is to become the property of the University of Genoa, and will be erected under the direction of Prof. Penzig, the Director of the Botanic Garden; and it is hoped that it will be completed by the time of the International Botanical and Geographical Congress to be held in Genoa at the time of the great Columbus Festival in 1892. It is intended that the new Institute shall bear the name of the "Hanbury Botanical Institute."

During his visit to the Canaries, in 1889, made for the purpose of taking observations on the atmospheric absorption of the solar spectrum, Prof. O. Simony, of Vienna, landed upon the lonely rock of Zalmo, near the Island of Ferro, and discovered a very curious lizard, which was subsequently described by Prof. Steindachner (*Anz. k. Ak. Wiss. Wien*, 1889, p. 260) as *Lacerta simonyi*. At the request of Lord Lilford, Canon Tristram has also recently visited the same spot, and obtained some examples of this lizard, which Lord Lilford has presented to the Zoological Society's collection. Simony's Lizard is a fine large species, very dark in colour, but obviously allied to the well-known *Lacerta ocellata* of Southern Europe.

The fifth of the series of photographic exhibitions at the Camera Club, will be open for private and press view on Monday, May 5, at 8 p.m., and on and after Tuesday, May 6, it will be open to visitors on presentation of card. It will consist of photographs by the late Mrs. Julia Cameron.

The French Exhibition, which is about to be opened at Earl's Court, will illustrate the arts, inventions, products, and resources of France and her colonies, and will, it is said, include many of the best objects shown at the Paris Exhibition of last year.

An archæological museum has been established in connection with the University of Pennsylvania. *Science* says it contains—in addition to the American specimens—a fine collection of flints, bronze implements, and pottery from Europe, as well as objects from Asia, Africa, and the South Sea Islands. At the same University a museum of economic botany is about to be formed. It will consist of all kinds of woods, vegetable fibres, grains and drugs, arranged so as to illustrate the processes of manufacture from the raw product, and the various uses to which each material may be put.